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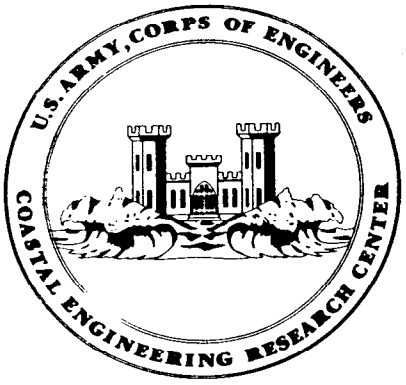

Coastal Engineering Technical Note

BIOLOGICAL EFFECTS OF A RUBBLE-MOUND STRUCTURE ON THE CALIFORNIA COAST

Problem: Solutions to many pressing coastal problems require the construction of rubble-mound structures on our coastlines or in the nearshore zone. These structures, most commonly built on the unconsolidated sediments of the nearshore zone provide a new and diverse habitat for marine organisms that generally colonize reefs but do not inhabit sandy or muddy bottom areas. It has long been known that desirable reef habitat is created whenever new surfaces are introduced into the nearshore; however, the actual changes and the derived benefits have not been adequately described. A study of the rubble revetment on Rincon Island off the California coast provides some preliminary guidance for evaluating the ecological benefits of such structures.

Effects of Rubble Mound Structures:

1. Nine distinct species groups (associations) were identified on the rubble structure. These nine species groups occurred at different elevations as bands of increasing width with increasing depth around the island. The groups varied with wave exposure, depth, slope, and light penetration.
2. A "talus slope" of mussel shell at the base of the island divides it from the natural bottom on all but the most wave-sheltered side. Over 90 percent of the shell was on the most wave-exposed side of the island where 16.5 cubic meters of shell has accumulated per meter of lineal distance along the revetment in the 19 years following island construction. The shell appeared to offer additional reef habitat and some scour protection to the base of the island.

3. The biota on the sides of the island were considerably more abundant and diverse relative to biota at corresponding depths on the natural bottom adjacent to the island or between the island and the shore. Three-hundred seventy-six species of benthic plants and invertebrates were observed on the sides of the island, whereas only 62 species were observed on the natural bottom.

4. It was estimated that the sides of the island supported 329,500 kilograms of wet-weight biomass, compared to 900 kilograms for an equal area of natural bottom. This indicates the island is about 370 times more productive in benthic biomass than the natural bottom.

5. Rubble structures can provide a major beneficial effect on local ecological conditions. The quarrystone and concrete armor units offer habitat features which are not found in a natural sedimentary bottom area. The solid substratum is colonized by a high diversity of encrusting and attached biota. Many of these are habitat-forming species in the sense that they provide shelter and food for additional species. High relief and vast amounts of interstitial space attract many species of fishes which are seldom or never encountered over sedimentary bottom areas.

Recommendations:

1. In planning for rubble structures, planners should evaluate the impacts of the structure on high quality habitat such as fish and invertebrate spawning grounds, shellfish beds, existing reefs and outcrops in the area, and on fish migration routes to make sure the beneficial effects of the structure are not offset by adverse impacts.

2. The use of rubble material large enough to be stable under wave action will create habitat for marine fish.

3. The use of a sloping structure will provide the maximum marine habitat and reef quality.

4. District offices may wish to consider the beneficial biological effects of rubble structures in their weighing of alternatives.

ADDITIONAL INFORMATION: For further information contact E. J. Pullen (WESER-C) (601) 634-3650

Reference: JOHNSON, G.F., and DeWIT, L.A., "Ecological Effects of an Artificial Island, Rincon Island, Punta Gorda, California," Miscellaneous Report No. 78-3, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Ft. Belvoir, VA, September 1978.